Suicide by crashing into a heavy vehicle: Focus on professional drivers using in-depth crash data

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Title: Suicide by crashing into a heavy vehicle: Focus on professional drivers using in-depth crash data

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ABSTRACT

Objective: Road traffic suicides typically involve a passenger car driver crashing their vehicle into a heavy vehicle, as death is almost certain due to the large mass difference between these vehicles. For the same reason, heavy vehicle drivers typically suffer minor injuries, if any, and have thus received little attention in the research literature. In this study, we focused on heavy vehicle drivers who were involved as the second party in road suicides in Finland.

Methods: We analyzed 138 road suicides (2011–2016) involving a passenger car crashing into a heavy vehicle. We used the in-depth road crash investigation data from the Finnish Crash Data Institute.

Results: The results showed that all but two crashes were head-on collisions. Almost 30% of truck drivers were injured, but only a few suffered serious injuries. More than a quarter reported sick leave following their crash. Injury insurance compensation to heavy vehicle drivers was just above 9000€ on average. Material damage to heavy vehicles was significant, with average insurance compensation paid being 70 500€. Three out of four truck drivers reported that drivers committing suicide acted abruptly and left them little opportunity for preventive action.

Conclusions: Suicides by crashing into heavy vehicles can have an impact on drivers' well-being; however, it is difficult to see how heavy vehicle drivers could avoid a suicide attempt involving their vehicle.

Key words: Heavy vehicle drivers; motor-vehicle crashes; violent suicide; driver suicide; self-destruction.

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INTRODUCTION

It has long been known that some road traffic fatalities are the result of deliberate self-destructive actions by motor vehicle drivers and other road users. The number and proportion of road suicides varies between different countries not only due to cultural factors, but also due to difficulties in identifying such cases and in the investigation efforts in different jurisdictions. If no suicide note is left behind it might be difficult to recognize suicidal intention (Stanistreet et al. 2001). This can be especially difficult because some people choose to die in a car crash precisely because such an "accident" would mask their intentions (Henderson and Joseph 2012; MacDonald 1964) and allow them to die in a socially acceptable manner (Morild 1994).

From the traffic safety and general injury prevention perspectives, it is important to separate suicides from other causes, as the prevention measures are largely different. Some countries exclude suicides from official road crash statistics (e.g., Norway and Sweden; Airaksinen et al. 2016). Therefore, much research has been devoted to investigating the scope of the problem and how to adequately distinguish suicides from "normal" crashes (Stanistreet et al. 2001; MacDonald 1964; Öhberg et al. 1997).

Another complementary line of research focuses on risk factors and groups. Psychiatric illnesses, alcohol and substance use, age, sex, and social circumstances including financial and relationship problems have been linked to reasons for committing suicide (WHO, 2014). As with other types of violent suicides, road suicides are more prevalent among men than women (Hernetkoski and Keskinen 1998; Isometsä and Lönnqvist 1998). The widespread availability of motor vehicles poses little restriction on the choice of this particular method, and provides many opportunities for latent suicidal ideation or tendency to be realized in an impulsive way, i.e. without any special preparation. Although impulsive suicides are probably less likely to be lethal than non-impulsive attempts (Rimkeviciene et al. 2015), crashing into a fixed barrier (e.g., a tree, a pillar) or a heavy vehicle at high speed hardly provides the opportunity for another attempt.

Traditionally, the focus of vehicular suicide has been on single-vehicle crashes (Jenkins and Sainsbury 1980; Connolly et al. 1995; Pompili et al. 2006) because running off the road and crashing into a hard object such as a tree can easily be attributed to the driver's loss of control and may mask real intentions, especially in the absence of eye-witnesses. However, most confirmed road suicides are collisions with another, typically heavy, vehicle (Björnstig et al. 2008; Hernetkoski et al. 1998; Gauthier et al. 2015; Sassi et al. 2018). The occupants of the other vehicle, if they survive, as heavy vehicle drivers normally do, can provide valuable information for investigation processes into the actions of the car driver just before the crash.

An analysis of 84 road suicides in Finland showed that 80% were collisions between vehicles with a large weight disparity (Öhberg et al. 1997). Another Finnish study reported that suicide-related collisions typically involved a heavy vehicle, but did not specify the exact proportion (Hernetkoski et al. 1998). In a Swedish study, 10 out of 13 investigated suicides were crashes with a heavy vehicle (Björnstig et al. 2008). Given the large weight difference between passenger cars and heavy vehicles, passenger car occupants are much more likely to suffer serious injury or die than heavy vehicle drivers. This lower probability of injury and the above-mentioned interest in drivers committing suicide means that heavy vehicle drivers have not normally been the focus of research. Typically, studies only mention the proportion of

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heavy vehicles as the other party in suicide crashes and whether the drivers were seriously injured. For example, Öhberg et al. (1997) reported that in almost 4% of cases another person had died and briefly described all these three cases.

Therefore, we analyzed cases that had been investigated by multidisciplinary investigation teams. This is part of a larger project on road suicides focusing on heavy vehicle drivers and combining several data sets and methods. This project includes an analysis of in-depth crash data, a survey collected from a representative sample of Finnish heavy vehicle drivers, a focus group study and a one-year follow-up study of heavy vehicle drivers who were involved as the second party in road suicides. The current study is the first of its kind with the explorative aim of examining the heavy vehicle drivers' injuries and sick leaves as well as their reports concerning the collision circumstances, including the preventive measures they applied or failed to apply.

METHODS

Finnish Crash Data Institute In-Depth Investigation Method

We used the in-depth road crash investigation data of the Finnish Crash Data Institute (In Finnish: Onnettomuustietoinstituutti-OTI). This worldwide unique data collection system started in the late 1960s, and so far more than 15000 fatal crashes have been investigated and documented. The investigation method has undergone several revisions, the last of which was in 2003. Each fatal crash is investigated by one of the twenty regional multidisciplinary teams consisting of a police officer, a vehicle engineer, a traffic engineer, a physician, and a psychologist or behavioral scientist. The teams collect all available information at the scene of the crash (e.g., interviews with survivors and eyewitnesses, alcohol tests, analyses of vehicle positions, braking marks) and later combine this with data from national driver records (e.g., driving under the influence, speeding offenses) and health care centers (e.g., history of alcohol abuse, psychiatric illnesses). If the driver does not survive, the team obtains an autopsy statement and interviews the deceased's relatives to learn of any relevant background information (e.g., previous suicide attempts if deliberate action was suspected).

Based on all collected material, the team produces a summary report that includes an explicit decision as to the primary cause, called 'immediate risk factor.' The team also lists the risk factors that contributed to the crash. In a typical suicide case, the team's decision would be based on objective data (e.g., no braking marks, excluding illness attack based on autopsy results), eyewitnesses reports (e.g., high speed, sudden movement, no brake lights), reports from another party in the crash (e.g., eye contact, sudden movement), family and friends reports (e.g., suicidal note, recent depression, suicidal thoughts, previous suicide attempts) and medical records (e.g., past hospitalization due to attempted suicide, psychiatric illnesses).

This investigation is separate from an official police investigation; however, OTI documentation typically includes material from official investigations such as police examination records. It is important to note that official investigations can potentially lead to criminal proceedings, whereas the OTI investigation is confidential and only serves traffic safety purposes. All the original documents are stored in files available to researchers, and more than 500 variables regarding participants, vehicles, the traffic situation, and road and weather conditions are imported into the

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OTI's computerized database. Two separate databases exist. One covers crashes in which at least one motor-vehicle occupant died. We used this database in our study. The other covers cyclists and pedestrian fatalities.

Sample Selection

We used both a computerized database covering six years (2011-2016) and original investigation folders. Suicide cases were identified using an 'Intentional action' category in an 'Immediate risk factor' variable. According to the computerized database, a total of 180 road suicides occurred during 2011-2016. As our focus was on heavy vehicle drivers, we excluded 22 single vehicle crashes, 12 crashes between two passenger cars, three crashes between a van and a passenger car, two crashes including a motorcycle, two crashes involving a bus as the opposite party, and one case in which a tractor was the opposite party. The final sample, therefore, consisted of 138 cases (Figure 1).

Procedure

As official examination records provide detailed information regarding the participants' views of their crash and references to possible insurance and other claims, attempts were made to ensure that folders are complete before data analysis begins. The first author screened 138 folders and identified those without official examination records of heavy vehicle drivers (N=68). OTI officials and research assistants then ordered these from police departments from around Finland. We received 39, so we had 109 folders with examination records.

Two research assistants were employed and instructed (by the first and second author) in how to extract the necessary information from the original investigation folders. None of them had previous experience with OTI material. The assistants independently read the original folders and extracted the relevant information. They discussed each case and agreed upon the final version. The first author supervised the process. It should be noted that the assistants did not re-evaluate the OTI teams' decisions regarding whether the cause of each crash was indeed a suicide.

Extracted Variables

The research assistants extracted the following variables: nationality of the truck driver (foreigners with a Finnish driver license were also coded as Finns); country in which the heavy vehicle was registered; truck driver's injury (no information, no injury, minor, or serious injury) and sick leave (no information, no, or yes; duration in days if answered 'yes'); whether the truck went off the road, fell on its side or caught fire (for these three variables coding was no information, no, partly, and completely); the truck driver's view of the crash, including information about their own preventive action and the actions of the other driver (slowly vs. abruptly diverting the vehicle).

Insurance Data

The Finnish Motor Insurers' Centre (In Finnish: Liikennevakuutuskeskus-LVK) handles compulsory motor liability insurance, and provided us with information regarding the insurance compensations paid to innocent parties, which in our sample were the heavy vehicle drivers. The matching of cases was done by LVK's data storage specialist. It was performed in-house as OTI is an integral although independent part of LVK. We report personal injuries and property damage to the heavy vehicle drivers and the owners of their vehicles separately.

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The study was approved by the University of Helsinki's Ethical Review Board in Humanities and Social and Behavioral Sciences. However, the insurance part was not specified in the research plan, as this opportunity only arose during the project.

RESULTS

insert Figure 1 about here

Crash Types and Involved Participants

Almost all crashes (N=136, 98.6%) were head-on collisions, including two cases of driving in the wrong direction on a motorway. The remaining two crashes occurred at a junction. In one of these, a car crashed into the back of a turning truck and in the other, a car driver first stopped his car in a connecting road and then suddenly moved it in front of the oncoming truck.

Almost all crashes (N=136, 98.6%) included two vehicles: in three cases a van crashed into a truck, while the remaining 133 cases were collisions between a passenger car and a truck. In one of two multiple crashes, another passenger car became involved after the main collision and in the other case, the third involved vehicle was a truck (appendix). In most cases (80.4%), the truck also had a trailer. In two cases, a passenger was present in the car of the driver committing suicide. In one of these two cases, it seems the driver and the passenger had decided to die together; however, in the other case this was not confirmed, despite the fact that the passenger survived, albeit with severe head injuries. Fourteen passengers were present in 12 trucks. Five of these were under the age of 18.

Injuries and Sick Leaves

According to the computerized database, two truck drivers were seriously injured and 33 suffered minor injuries; however, based on the information extracted from the examination records, an additional six drivers had suffered a minor injury. This means that almost 30% of the truck drivers were injured in suicides that involved crashing into their vehicle. Out of the 14 passengers present in the 12 trucks, three suffered slight injuries (appendix). None of the five children were physically injured.

From the original folders (largely from the available examination records), we found that seven (5.1%) truck drivers went back to work immediately after the crash, and 32 (23.2%) reported sick leave. No information was found in 99 (71.7%) of cases. Sick leave duration varied from 2 to 161 days (mean 30 days, median 14.5 days); however, the exact duration is not known, as 12 drivers were still on sick leave when they were interviewed. For one of these drivers, long-term physical rehabilitation was predicted, while the other driver said he was not mentally ready to continue driving and was not sure whether he ever would be.

The majority of the drivers were Finnish citizens or residents (83.3%) driving trucks mostly registered in Finland (89.1%). The availability of examination records did not differ (χ^2=1.06, d.f.=1, p=0.304) between Finnish citizens/residents (89/115; 77.4%) and the rest (20/23; 87%).

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Insurance Consequences of the Crashes

We obtained no information for seven cases and nine cases had incomplete data (e.g., based on OTI folders a truck was clearly damaged but no information about compensation was available) or unclear information (e.g., compensation costs paid to unknown participant). Furthermore, we excluded cases with foreign drivers and trucks from our analysis (N=23), leaving 99 cases with Finnish drivers driving trucks registered in Finland.

Personal injuries compensation: The average injury compensation paid was 9016€, with a range from zero to 214 430€. However, when we excluded 38 cases in which no compensation was paid, the average sum was 14632€ (median 2100€). About 30% of compensations were less than 1000€, 80% less than 10000€ and in six cases the compensation exceeded 45000€.

Material compensation: The average material compensation paid was 70520€ (median 61280€; range: 6400€ - 272230€). In 38% of cases, the compensation was less than 50000€ and in 81% below 100000€. These high costs are not surprising given the consequences of the crashes for trucks (Table 1).

insert Table 1 about here

Truck Driver's Preventive Action and Actions of Driver Committing Suicide

According to the computerized database, none of the truck drivers was intoxicated and only two were judged tired.

insert Table 2 about here
insert Table 3 about here

One driver who was unable to recall anything was excluded from Table 3, as were two others who had not noticed the suicide driver heading for their vehicles. One of these two was the previously mentioned case in which a car crashed into the back of the turning truck. In the other case, the truck driver thought his truck's tires had exploded, stopped to check them and then realized a car had crashed into his truck's left front side and was 100m down the road. A further nine cases were excluded from Table 3. We obtained no clear information regarding self-reported preventive action for six cases, and in three cases the drivers did not refer to the actions of the other participant.

DISCUSSION

To the best of our knowledge, this is the first study to focus on the other party in road traffic suicides. It also shows that this neglect is unfortunate, as suicides involving crashing into heavy vehicles can have an impact on drivers' well-being. The material damage costs are also significant.

Our data show that 30% of the truck drivers were injured, despite the large difference in mass between a passenger car and a truck. Two drivers suffered serious injuries, one of whom required a long rehabilitation period. In the official police investigation, a third driver mentioned having difficulties returning to his job. Three out of the 14 passengers in the 12 trucks also suffered minor injuries.

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We also found that at least 23.2% of truck drivers reported sick leave after the crash with a median duration of 14.5 days. This is probably an underestimation, as information about sick leave is not routinely collected by the OTI teams. On the other hand, it is up to each driver to mention possible sick leave during the official police investigation when they are asked about their demands regarding the crash. Such information is normally entered into an examination record. It seems likely that a driver would mention long rather than short sick leave periods. Consequently, any underestimation probably relates to shorter sick leaves. However, 29 examination records were missing so it is possible that the identified 23.2% of drivers with short or long sick leaves is an underestimate. Furthermore, some of the drivers were still on sick leave when they made examination reports, so we have probably also underestimated the duration of confirmed sick leave periods in our data. The injury compensation costs were also high, at an average of 9000€.

Anecdotal evidence exists that some entrepreneurs and small companies might go out of business after their trucks are damaged in crashes even when they are the innocent party and receive material insurance compensation (Airaksinen et al. 2016). It takes time for a truck to be repaired and if no replacement vehicle is immediately available, small companies might lose their customers and significant income. A high average material compensation of 70500€ indicates that many trucks have sustained serious damage. However, based on the available material, it was not possible to determine the kind of further direct and indirect costs incurred by the owners of these trucks.

Anecdotal evidence also suggests that the sudden actions of a driver who attempts suicide by crashing into a heavy vehicle leave little opportunity for the drivers of the heavy vehicles to avoid the crash. A simple calculation can illustrate this. If a heavy vehicle is travelling at a speed of 80km/h and a passenger car at a speed of 100km/h, and the car driver suddenly diverts their vehicle at a distance of 50 meters, it takes about a second for the vehicles to collide. According to the truck drivers in this study, only a small proportion (less than 5%) of suicidal drivers turned their vehicle in a relatively slow manner. In about 20% of cases (N=24), the truck drivers noticed the suicidal driver driving strangely (e.g., drifting, left tires on the central line) and typically expected them to correct the path of their vehicle. Instead the driver turned abruptly, leaving the truck driver hardly any time to react. Nevertheless, in 21 out of the 24 cases they reported applying some preventive action. Three quarters of the truck drivers reported that the other vehicle diverted abruptly towards them, leaving almost half of them with no time for any reaction.

Unlike other forms of suicide, those committed by crashing into a heavy vehicle directly and instantly endanger other people. Even the larger mass of a heavy vehicle and typically the higher seating position does not completely protect these drivers from physical injury, as our data indicate. How these drivers cope afterwards and whether they suffer from psychological trauma has also not been investigated to our knowledge. Posttraumatic stress disorder is common following a motor vehicle crash especially if a crash involves a fatality (Heron-Delaney et al. 2013). It seems, however, that Finnish heavy vehicle drivers involved in fatal crashes at least do not change their yearly mileage after the crash (Rajalin and Summala 1997). On the other hand, several studies of train drivers experiencing “person under the train” incidents indicate that they experience a successively deteriorating psychosocial work situation (Theorell et al., 1994) and some have moderate and severe posttraumatic stress symptoms (Mehnert et al. 2012). Furthermore, in our study, fourteen passengers, including five under the age of 18 were present in heavy vehicles and it is unknown whether and what kind of psychological consequences the event had on them.

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It is likely that those who commit suicide by crashing into a heavy vehicle are aware of the potential danger they might pose to their drivers. Any campaign addressing this issue would likely be counterproductive, given the well-known copycat problem (Phillips 1974) and the availability of motor vehicles. One possibility that has been considered in Finland is the revocation of a person's driving rights on the basis of immediate suicide risk (Airaksinen et al. 2016). According to the Finnish traffic law since 2004, medical doctors are obliged to inform police if the patient's fitness to drive has been seriously compromised. Although the Finnish Transport Safety Agency's 2016 fitness to drive instructions for medical professionals include detailed instructions for assessing suicide risk, applying them in practice is challenging as is this specific part of the traffic law in general (Peräaho et al. 2012). In terms of preventive actions, heavy vehicle drivers cannot do very much when the speed of both vehicles is above 80 km/h and the suicidal driver suddenly and abruptly diverts his vehicle towards another party.

The main limitation of the study arises from the fact that we relied on the material collected and stored by the multidisciplinary investigation teams. Furthermore, we did not re-evaluate their decisions that deliberate self-destructive action was the cause of each crash. However, previous studies that attempted to reanalyze teams' decisions reported high agreement regarding suicide cases (Airaksinen et al. 2016; Öhberg et al. 1997).

In conclusion, based on in-depth crash data, we presented evidence about how suicides by crashing into a heavy vehicle can have negative consequences also on professional drivers. Although it is difficult to propose any specific preventive measure that would reduce the number of road suicides, more research is needed into how heavy vehicle drivers in suicide cases involving their vehicle cope after the event.

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Table 1. Consequences of the crashes for trucks

	Truck went off the road	**Truck fell on its side**	**Truck caught fire**
Completely	50 (36.2%)	15 (10.9%)	1 (0.7%)
Partly	53 (38.4%)	17 (12.3%)	7 (5.1%)
No	34 (24.6%)	106 (76.8%)	127 (92%)
Unknown	1 (0.7%)	0	3 (2.2%)
Total	138 (100%)	138 (100%)	138 (100%)

Table 2. Preventive action of a truck driver according to OTI teams (computerized database)*

Preventive action	Computerized database
Braked, slowed down	41 (29.7%)
Swerved otherwise	34 (24.6%)
Tried to control the vehicle**	14 (10.1%)
Flashed lights/gave a sound signal	3 (2.2%)
Other	1 (0.7%)
No preventive activity	41 (29.7%)
Unknown	4 (2.9%)
Total	138 (100%)

* Computerized databases have no multiple answers.

** This preventive action does not make much sense in this case as it describes the actions following the crash, so cannot be regarded as crash preventive action. As we understand it, the reason for this is probably because in the old OTI method, this variable was "actions to prevent injury."

Table 3. Truck driver's report on actions of suicidal driver and own preventive action (data extracted from original folders)

	Actions of suicidal driver			
Self-reported preventive action	Slowly	Slowly then abruptly	Abruptly	Total
Braked	2 (33.3%)	2 (8.3%)	11 (11.5%)	15 (11.9%)
Swerved	1 (16.7%)	10 (41.7%)	20 (20.8%)	31 (24.6%)
Braked and swerved	1 (16.7%)	8 (33.3%)	19 (19.8%)	28 (22.2%)
Other combination	2 (33.3%)	1 (4.2%)	1 (1%)	4 (3.2%)
Said no time to react	0	3 (12.5%)	45 (46.9%)	48 (38.1%)
Total	6 (4.8%)	24 (19%)	96 (76.2%)	126 (100%)

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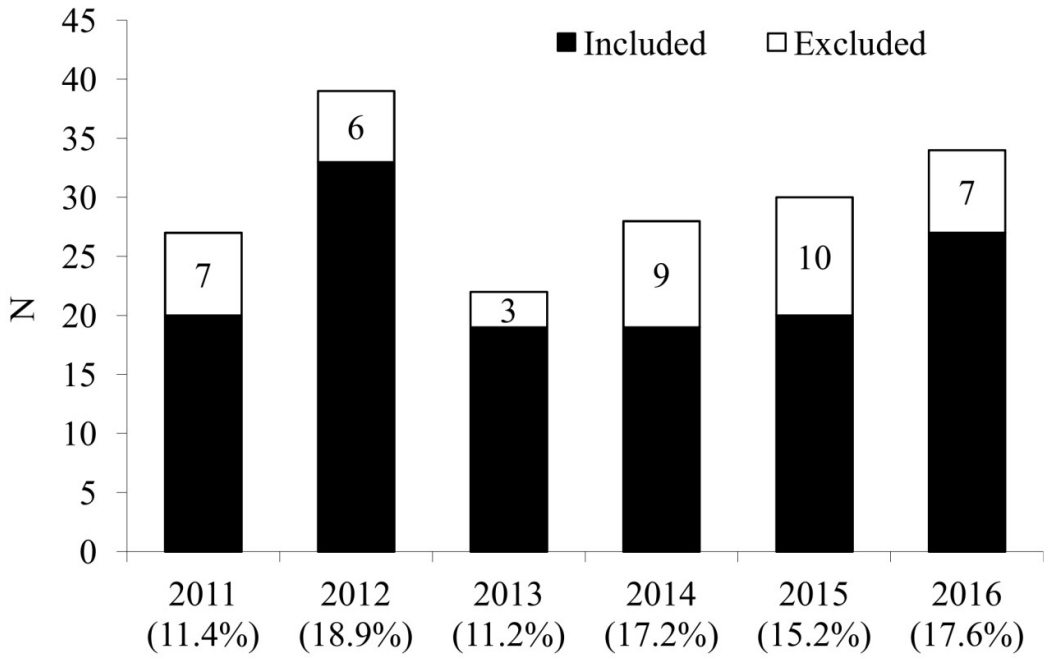

Figure 1. Number of included (N=138) and excluded cases (N=42) by year. Percentages in brackets represent the proportion of suicide cases of each year's motor vehicle fatal crashes

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SUPPLEMENTARY MATERIALS

Injury outcome for all involved drivers and passengers by crash type and vehicle

				
N=122	N=2	N=10	N=2	N=2
119 car and 3 van drivers died Truck drivers: 86 uninjured 35 slightly injured 1 seriously injured	2 car drivers died 1 passenger died and 1 seriously injured Truck drivers: 1 uninjured 1 slightly injured	10 car drivers died Truck drivers: 7 uninjured 2 slightly injured 1 seriously injured Truck passengers: 7 uninjured 3 slightly injured	2 car drivers died Truck drivers: 2 uninjured truck passengers: 4 uninjured	2 suicide car drivers died Truck drivers: 1 uninjured 1 slightly injured two 3rd participants (one in a car; one in a heavy vehicle): both uninjured